2023-2 Capstone Design Project

자리 있나요?
Empty Seats?

Midterm Presentation

Team A (A's) 김도엽 박재윤 우다연 최지민

Contents

Empty Seats?

Samsung library
book lounge

Haedong
library

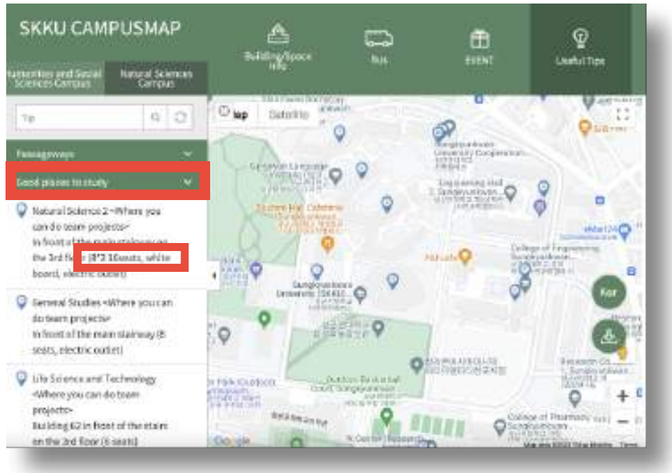
Eskara lounge

Real-time service about empty seats in school study spaces

Motivations

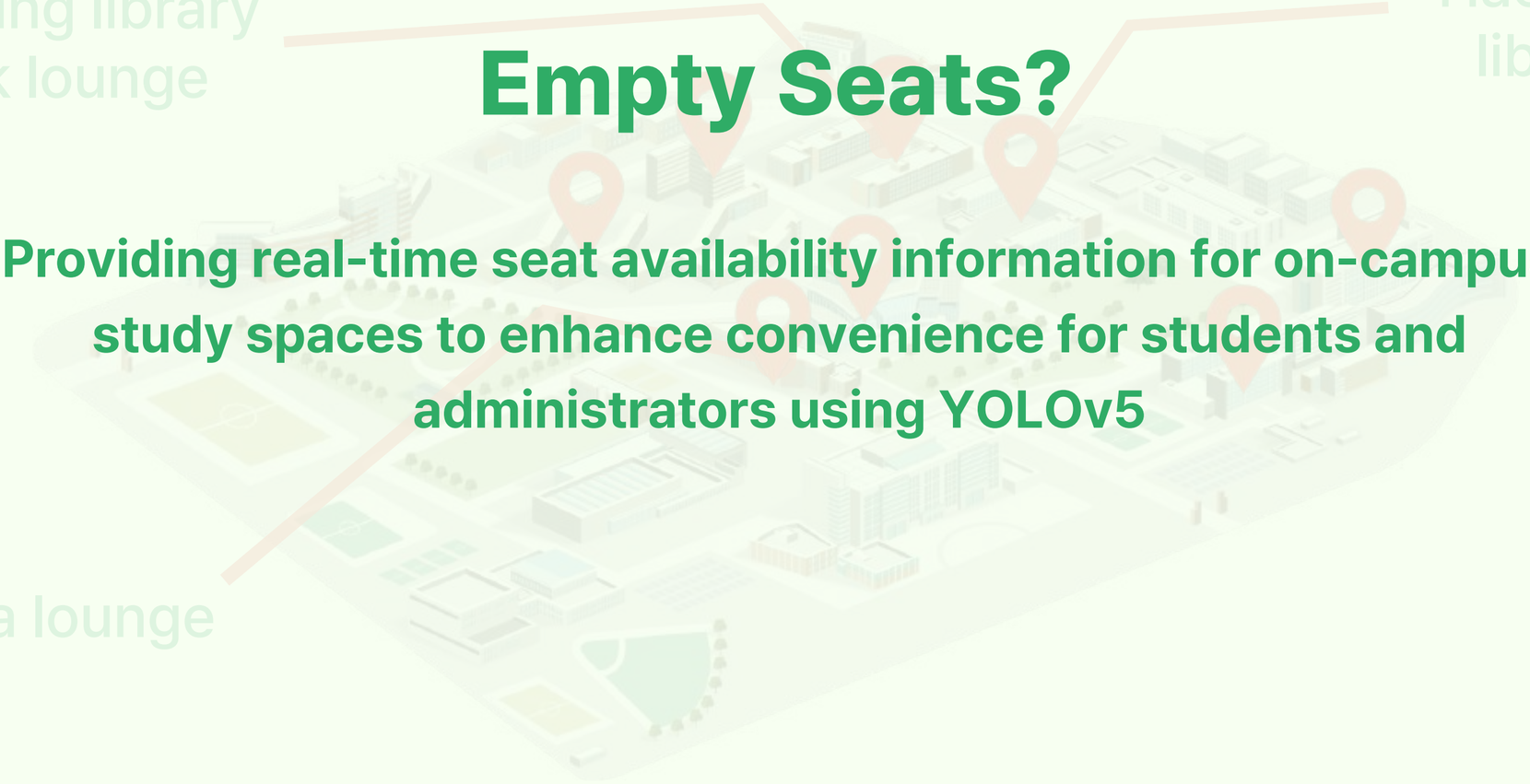
1) Everytime

2) SKKU CAMPUSMAP



3) Haedong Reservation System

Empty Seats?



Providing real-time seat availability information for on-campus study spaces to enhance convenience for students and administrators using YOLOv5

Roles

최지민
Video Pre-processing

최지민
Detecting

김도엽
Server

김도엽, 박재윤
Data Processing

우다연
Code Implementaion

박재윤, 우다연
UI / UX Development

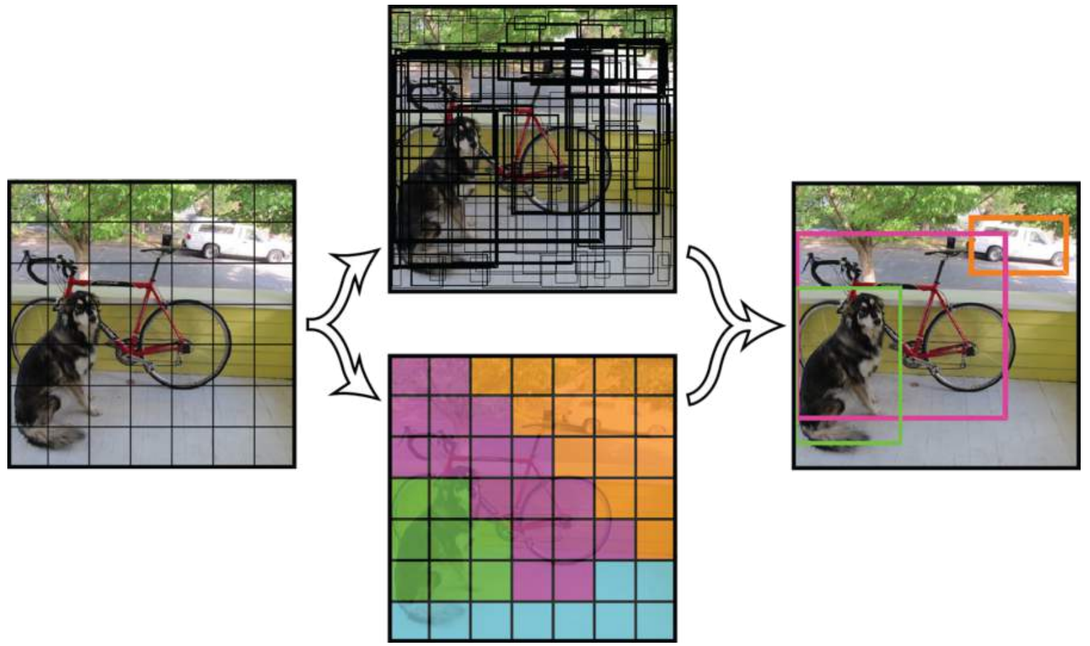
김도엽
Release

PART 02 I Background

- **Background - YOLO**

Mark the **locations** where the objects are likely to exist with **bounding boxes**

Divid the image into **grids**

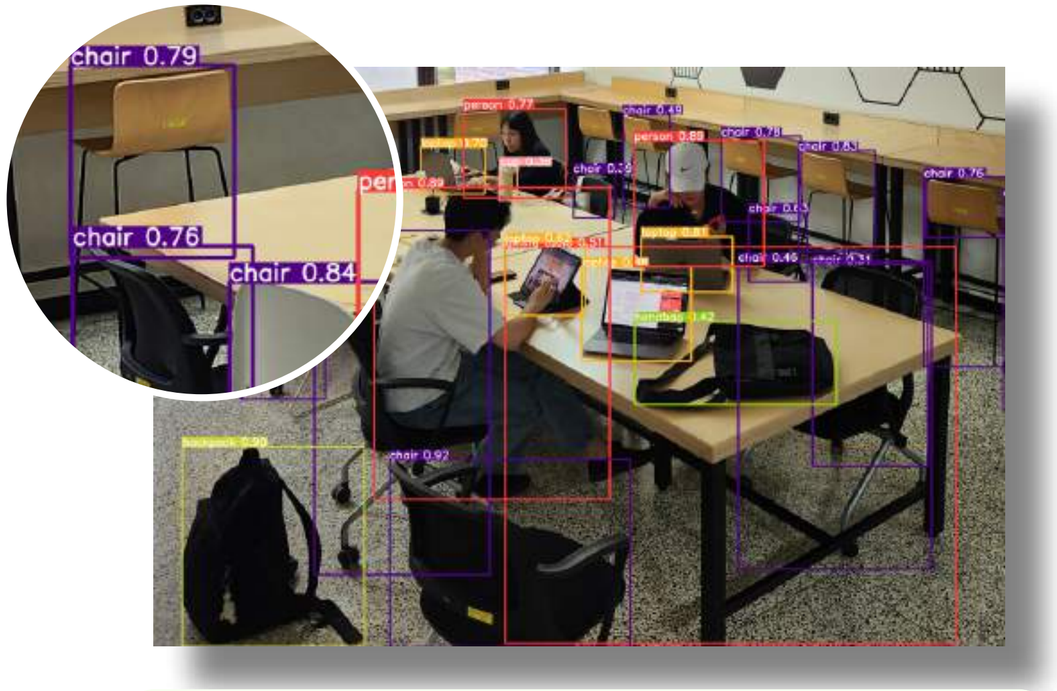


Select the **bounding boxes** that are most likely to have an object

Indicates the **class** to which each grid belongs

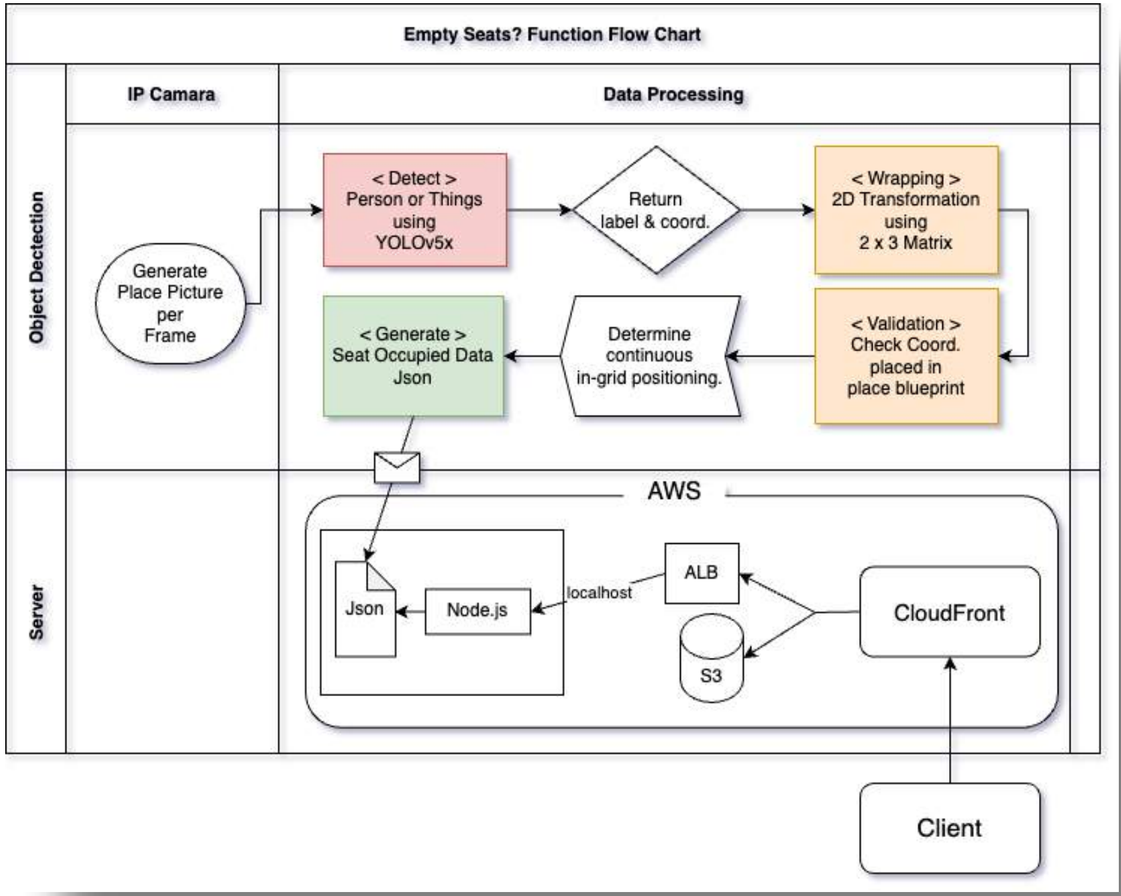
PART 02 I Background

YOLOv5x



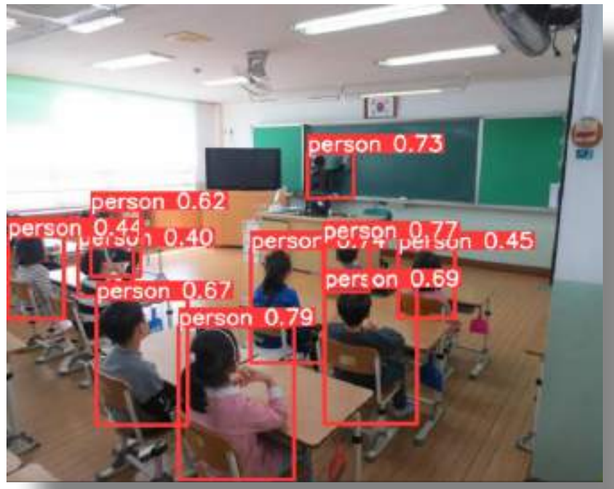
YOLOv5 is much easier to use
and performs well

PART 03 I Data Processing



PART 03 I Data Processing

Image

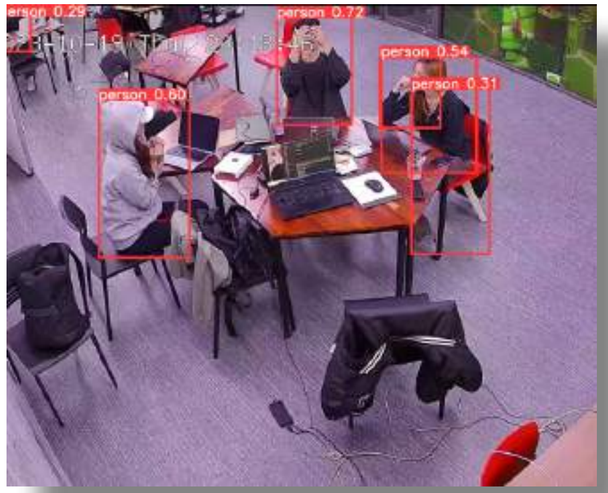


Detect at once

Video

Detect per frame

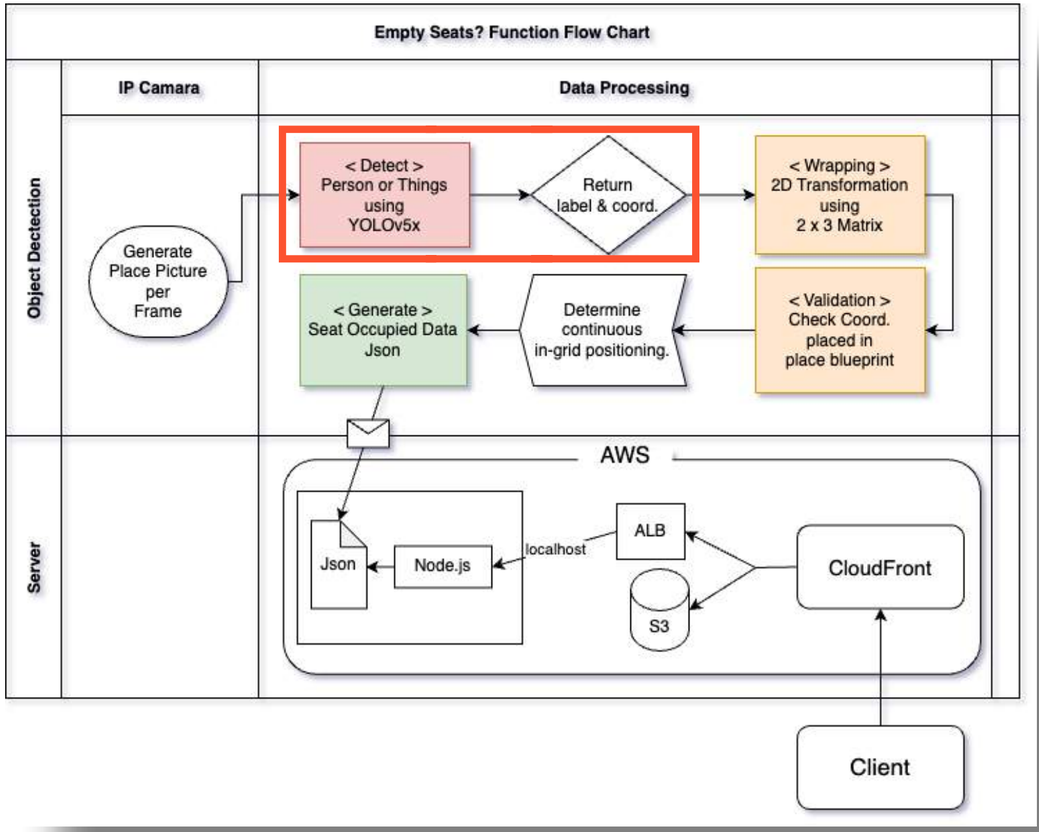
Webcam



Detect periodically
(Broadcasting in real-time)

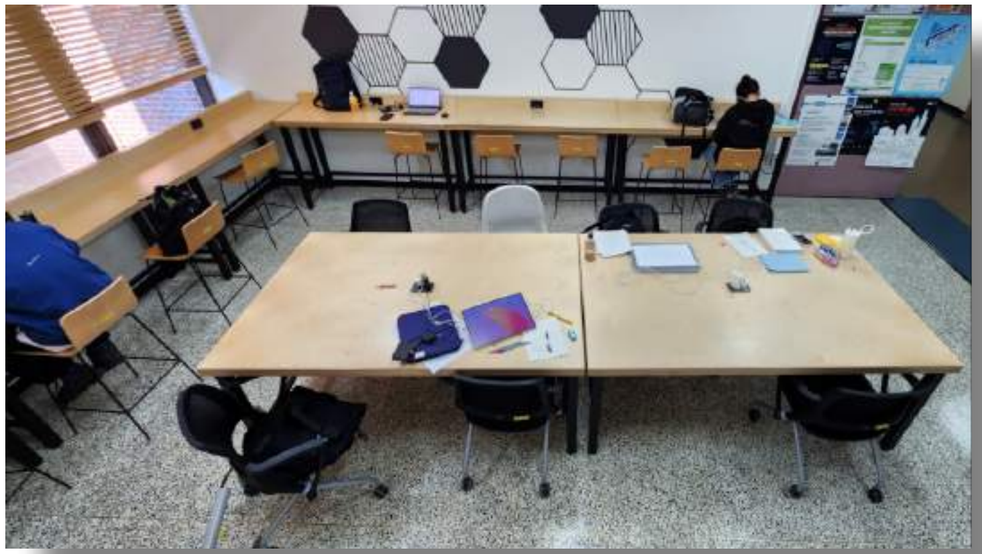
PART 03 I Data Processing

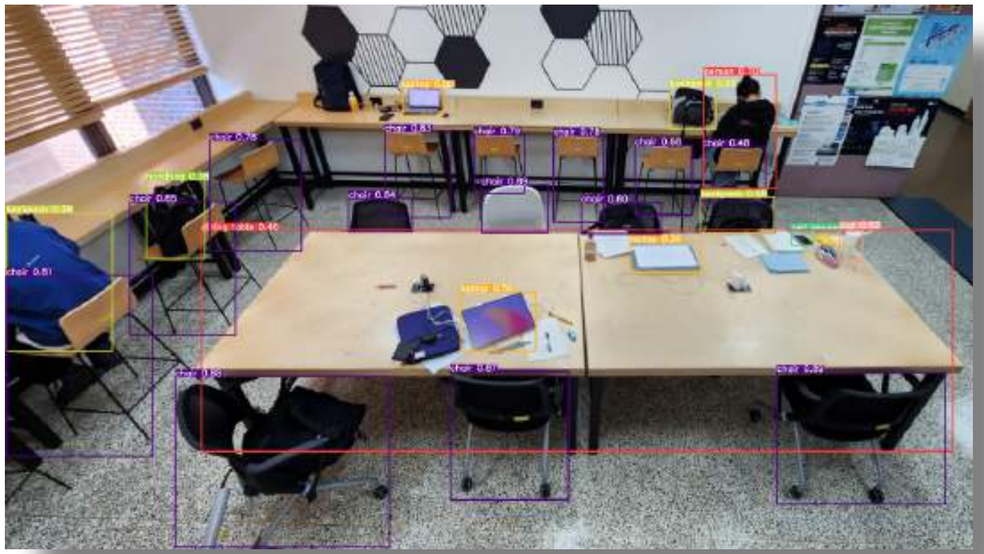
1) Detection



PART 03 I Data Processing

1) Detection

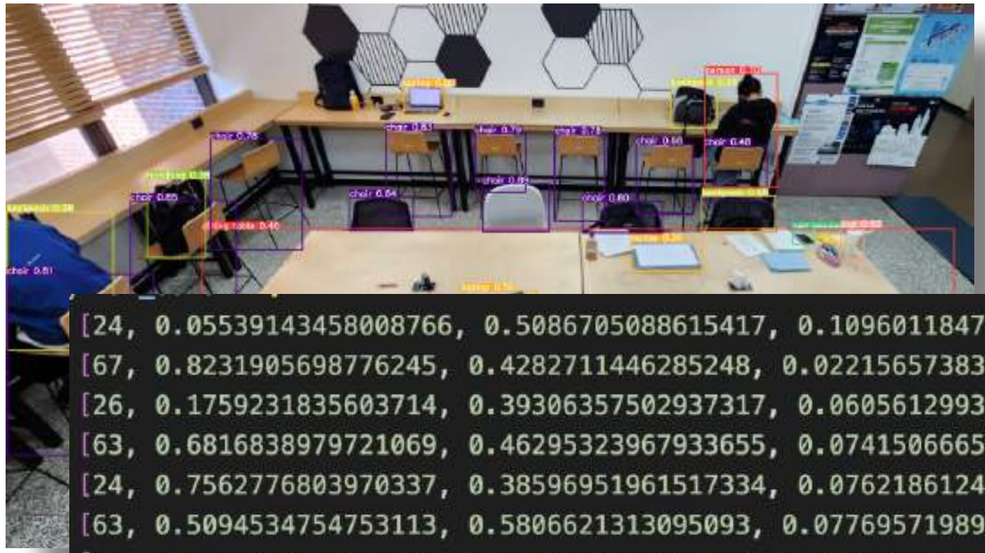




YOLOv5x

PART 03 I Data Processing

1) Detection



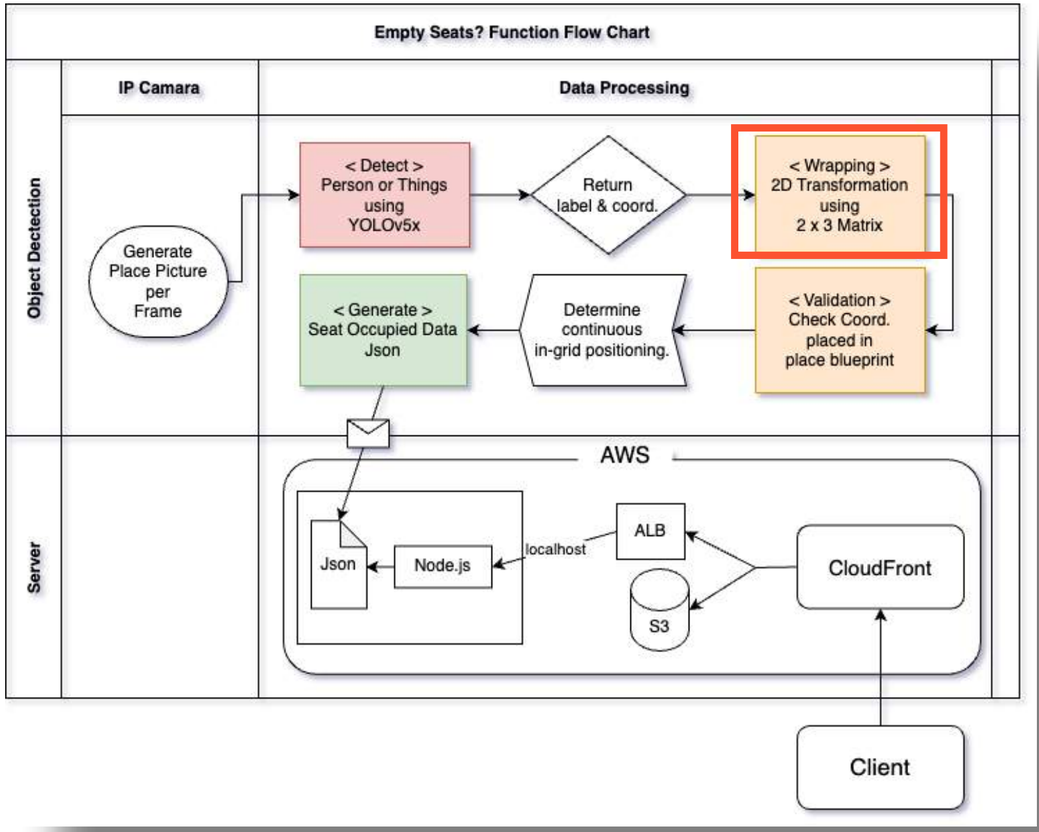
```
[24, 0.05539143458008766, 0.5086705088615417, 0.10960118472576141, 0.2543352544307709],
[67, 0.8231905698776245, 0.4282711446285248, 0.022156573832035065, 0.0262743029743433],
[26, 0.1759231835603714, 0.39306357502937317, 0.060561299324035645, 0.14503414928913116],
[63, 0.6816838979721069, 0.46295323967933655, 0.07415066659450531, 0.05570152401924133],
[24, 0.7562776803970337, 0.38596951961517334, 0.0762186124920845, 0.06673672795295715],
[63, 0.5094534754753113, 0.5806621313095093, 0.07769571989774704, 0.10930110514163971],
[24, 0.7100443243980408, 0.1886495053768158, 0.04697193577885628, 0.07882291078567505],
[0, 0.7590842247009277, 0.2320021092891693, 0.07474150508642197, 0.20861797034740448],
[63, 0.4311669170856476, 0.17682605981826782, 0.04224519804120064, 0.05202312022447586]
```

Label index & Coordinates (x, y, width, height)

```
label_map = {
    0: "person",
    73: "book",
    63: "laptop",
    62: "tv",
    65: "remote",
    67: "cell phone",
    64: "mouse",
    66: "keyboard",
    24: "backpack",
    26: "handbag"
}
```

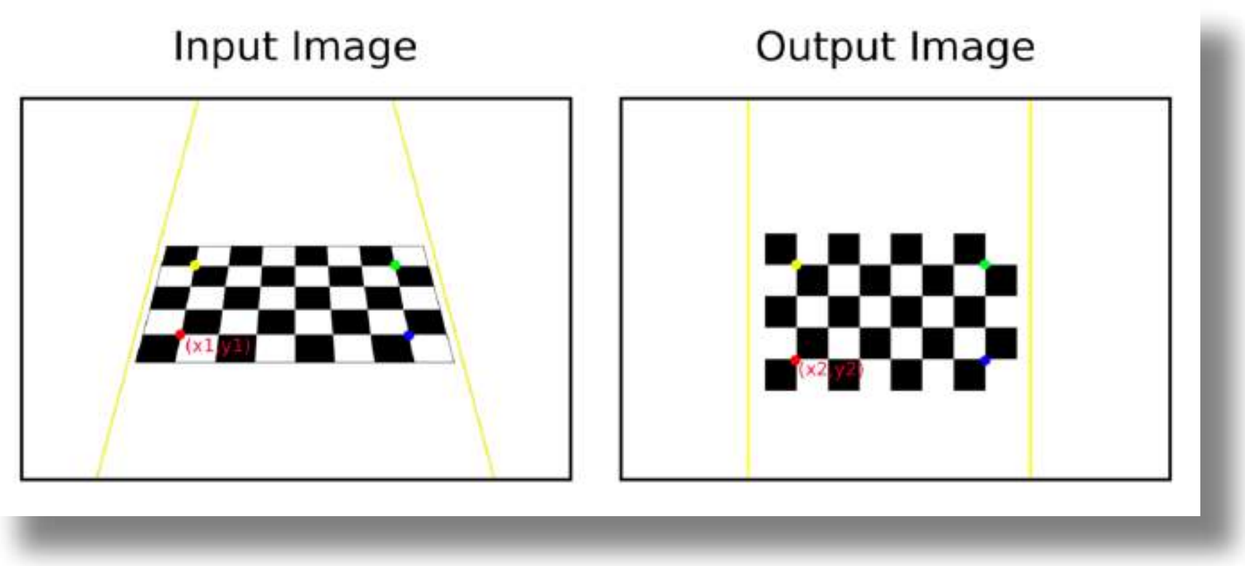
PART 03 I Data Processing

2) Perspective transformation



PART 03 I Data Processing

2) Perspective transformation

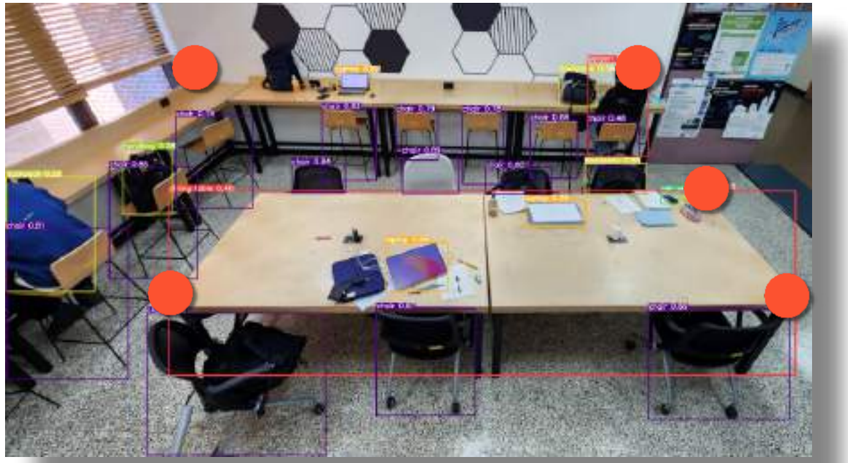


OpenCV Perspective transform

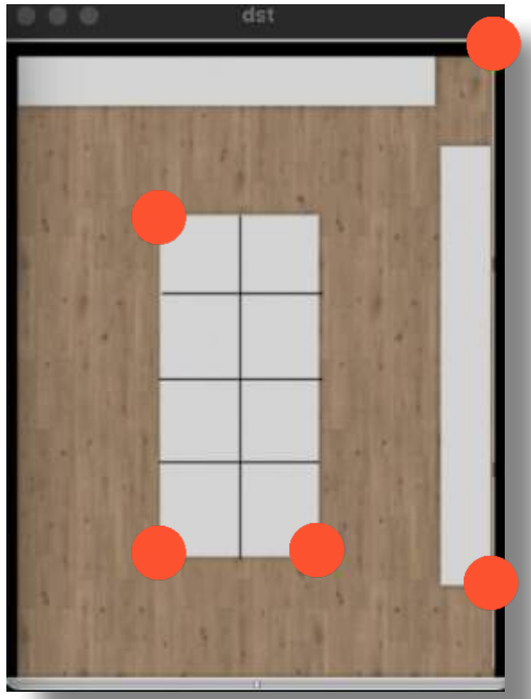
PART 03 I Data Processing

2) Perspective transformation

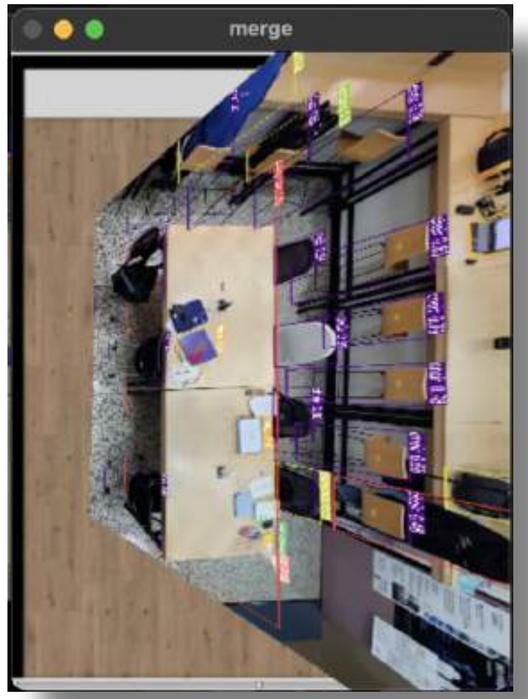
Original image



2D space



Transformed image



PART 03 I Data Processing

2) Perspective transformation

Transformed image

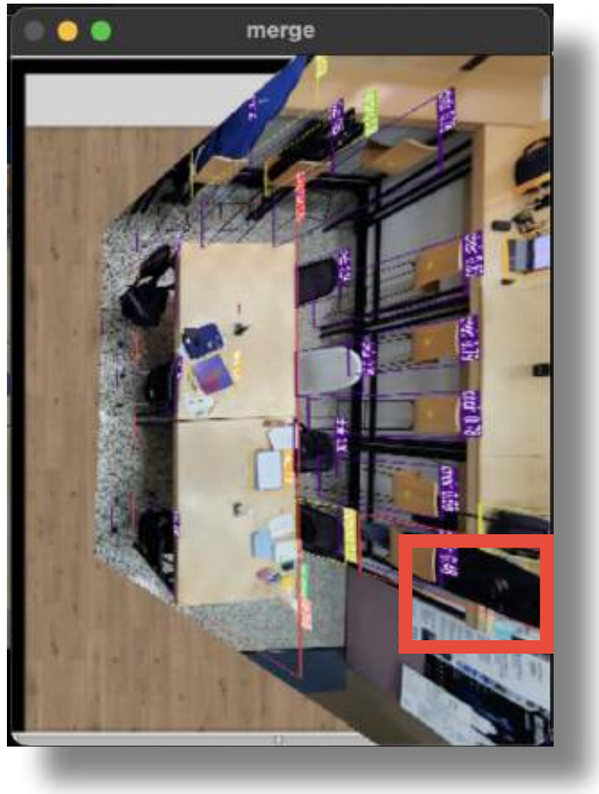
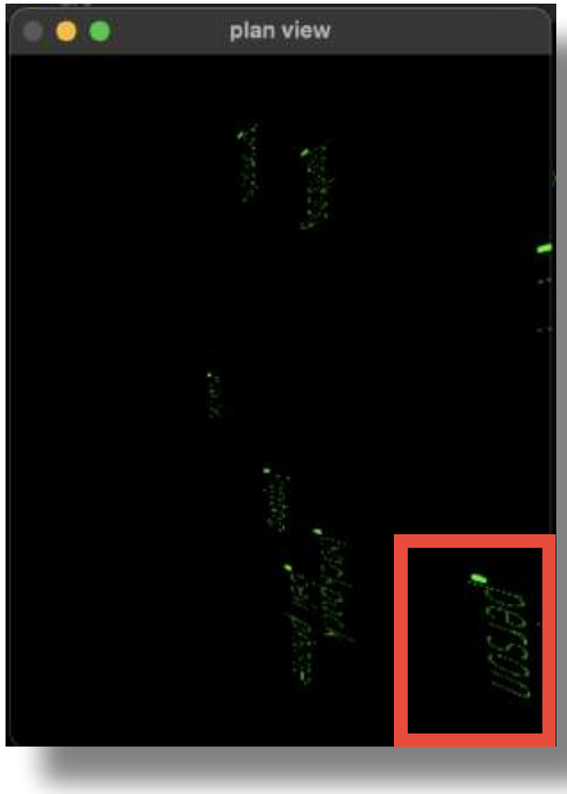
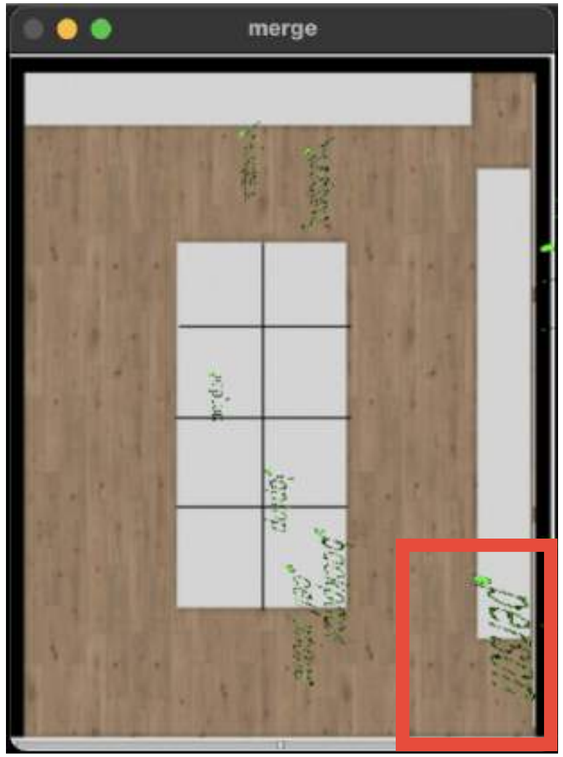


Image with labels only



Seating chart



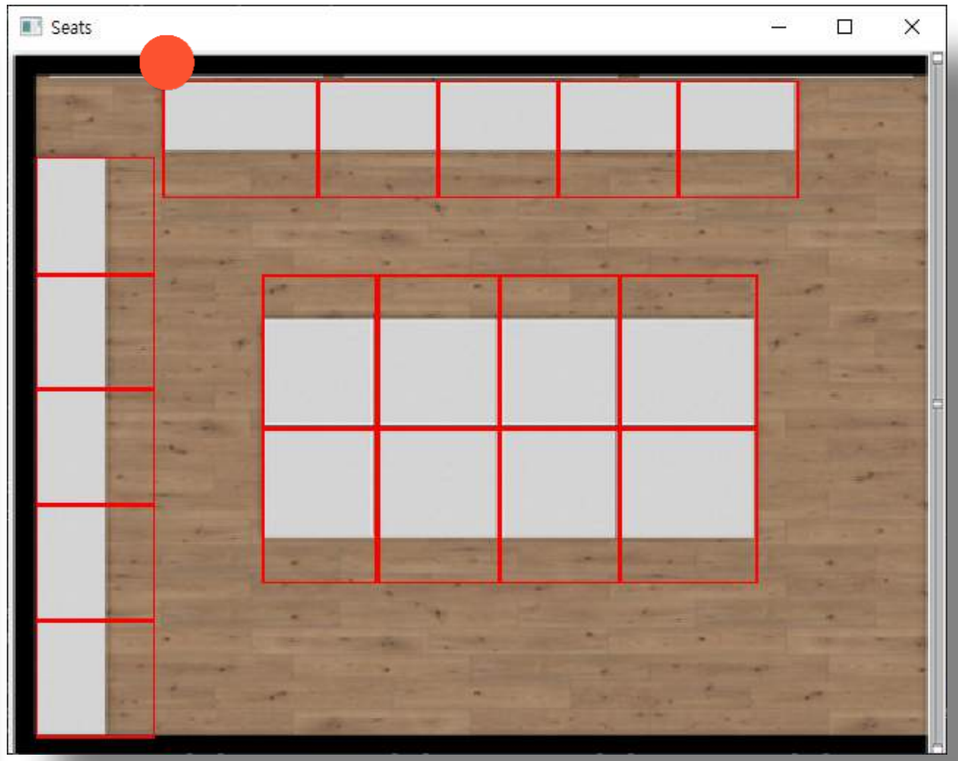
Occupied

PART 03 I Data Processing

3) Seat division

[x: 137, y: 14, w: 52, h: 33, dir: 3]

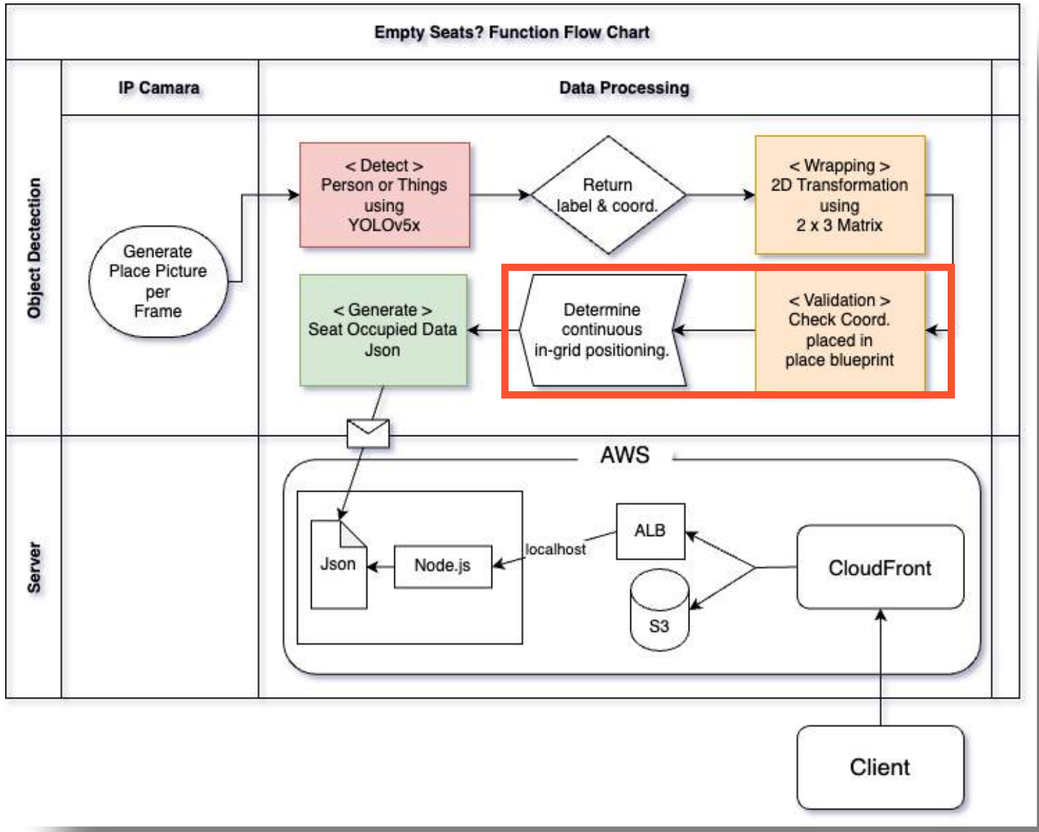
```
# [x, y, width, height, direction of chair]
# direction = 1:Up, 2:Right, 3:Down, 4:Left
psj_lounge_desk = [
    [12, 262, 32, 53, 2],
    [12, 209, 32, 52, 2],
    [12, 156, 32, 52, 2],
    [12, 103, 32, 52, 2],
    [12, 49, 32, 53, 2],
    [68, 14, 68, 33, 3],
    [137, 14, 52, 33, 3],
    [190, 14, 52, 33, 3],
    [243, 14, 52, 33, 3],
    [296, 14, 52, 33, 3],
    [112, 174, 50, 50, 3],
    [112, 123, 50, 50, 1],
    [163, 174, 53, 50, 3],
    [163, 123, 53, 50, 1],
    [217, 174, 52, 50, 3],
    [217, 123, 52, 50, 1],
    [270, 174, 60, 50, 3],
    [270, 123, 60, 50, 1]
]
```



Added hard-coded desk grid for seat area designation

PART 03 I Data Processing

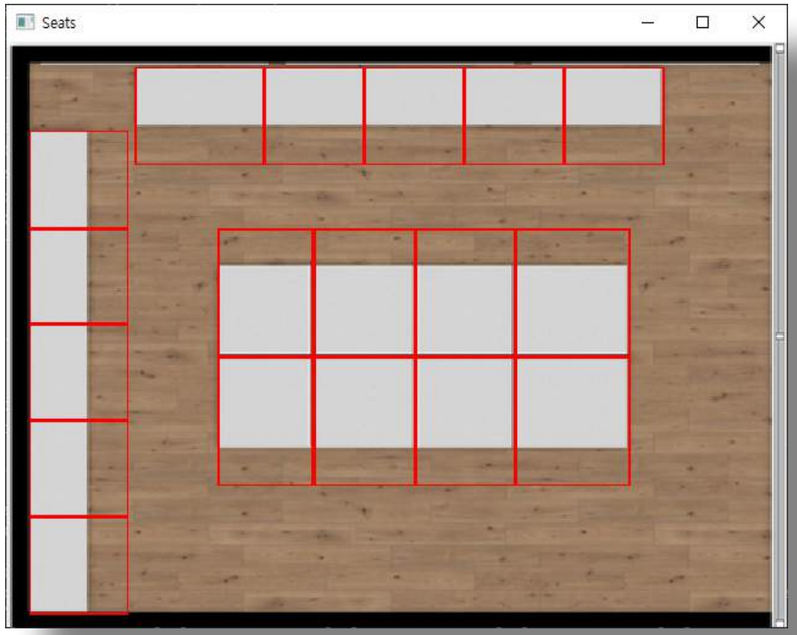
4) Seat occupancy indication



PART 03 I Data Processing

4) Seat occupancy indication

Grid-divided blueprint



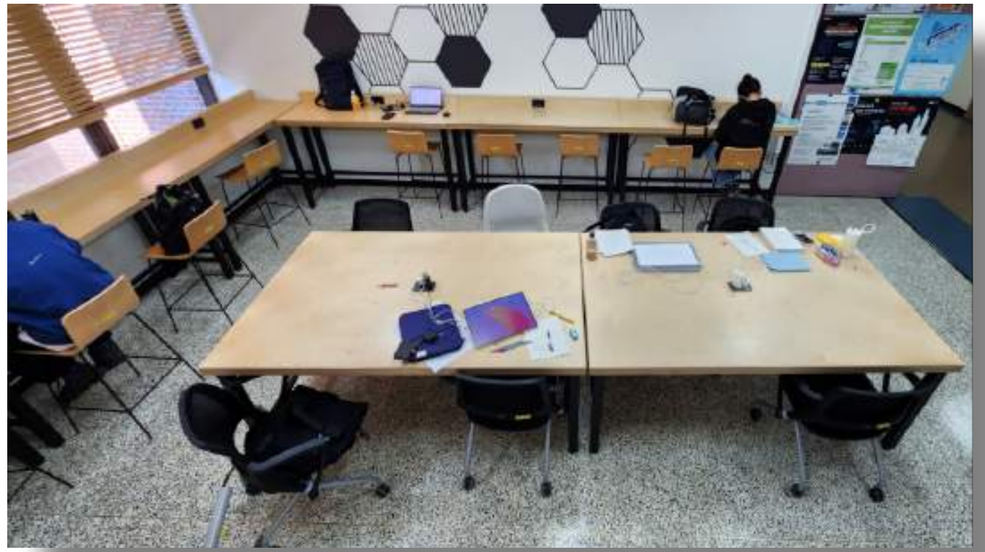
+

Transformed coordinates & Labels

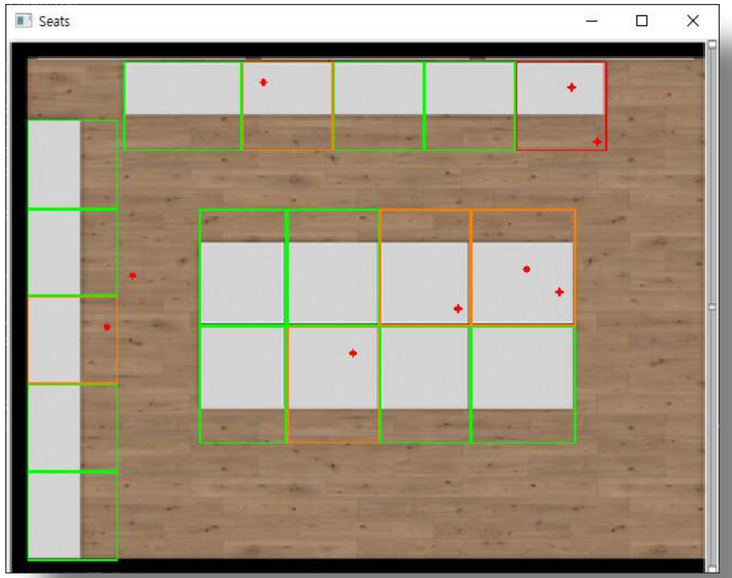
PART 03 I Data Processing

4) Seat occupancy indication

Captured image

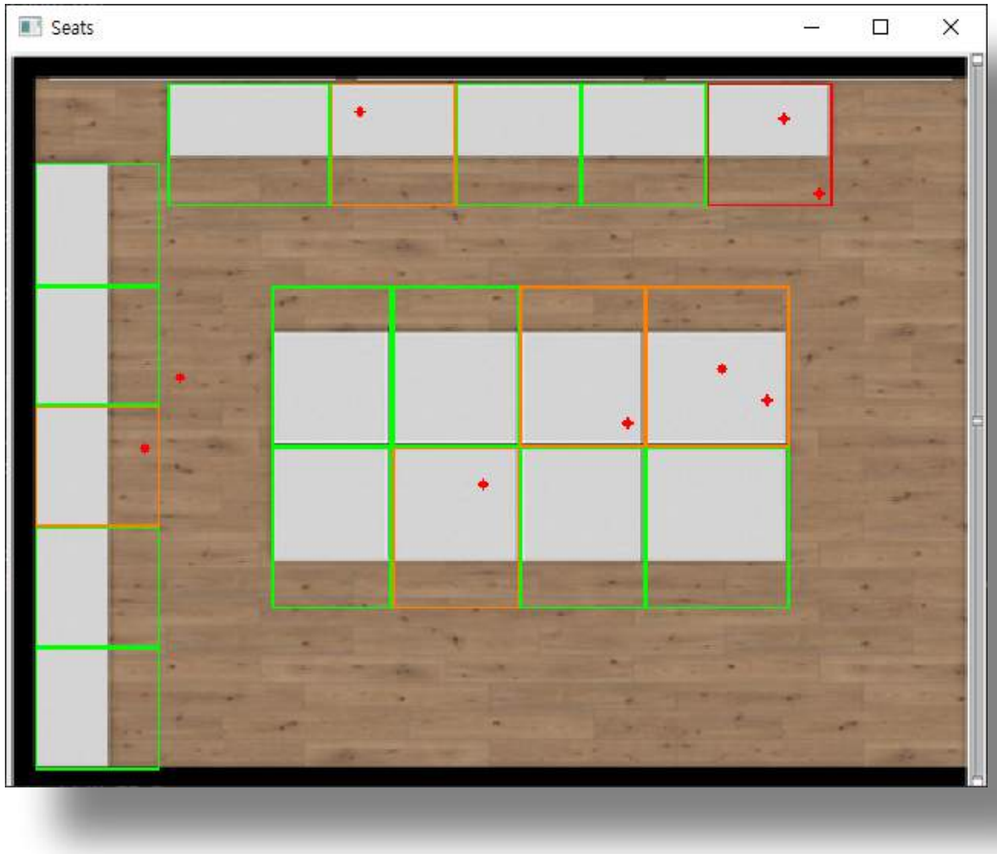


Blueprint indicating seat occupancy status



PART 03 I Data Processing

4) Seat occupancy indication



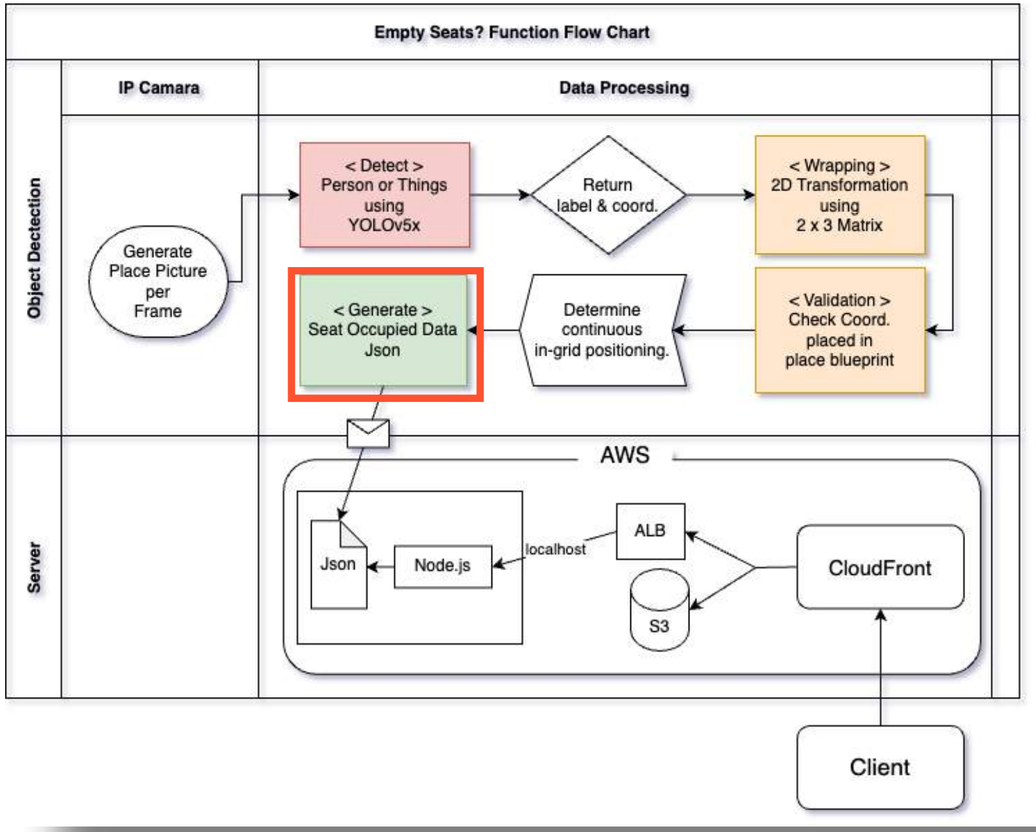
Occupied by person

Occupied by object

Available

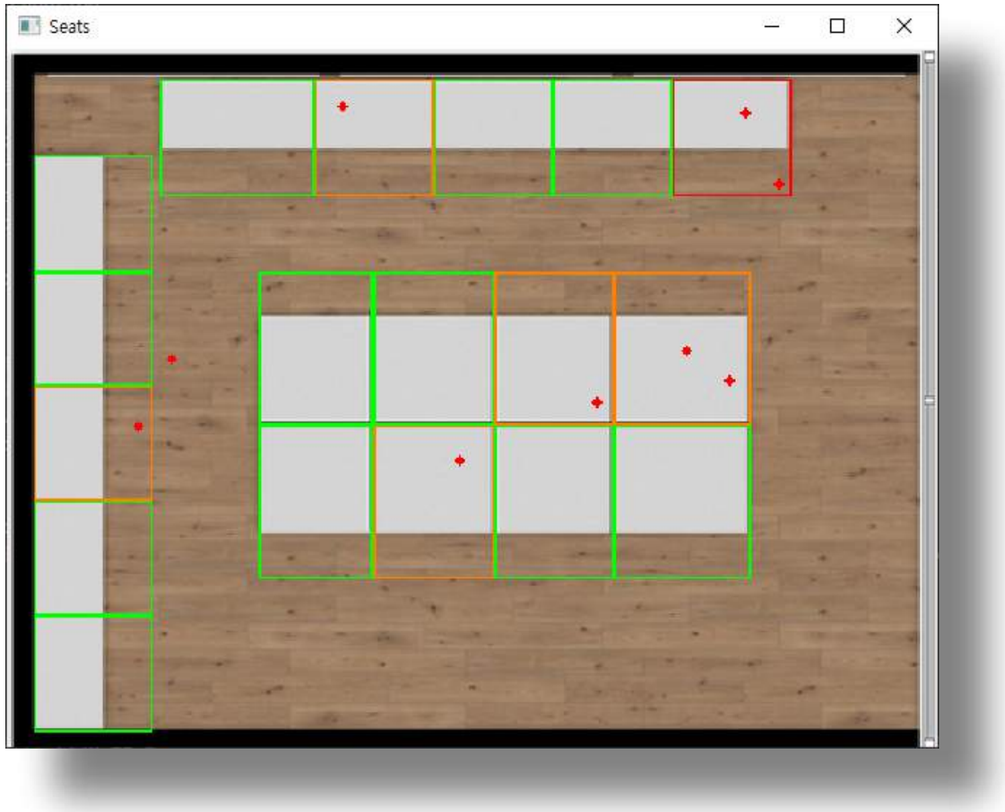
PART 03 I Data Processing

4) Seat occupancy indication



PART 03 I Data Processing

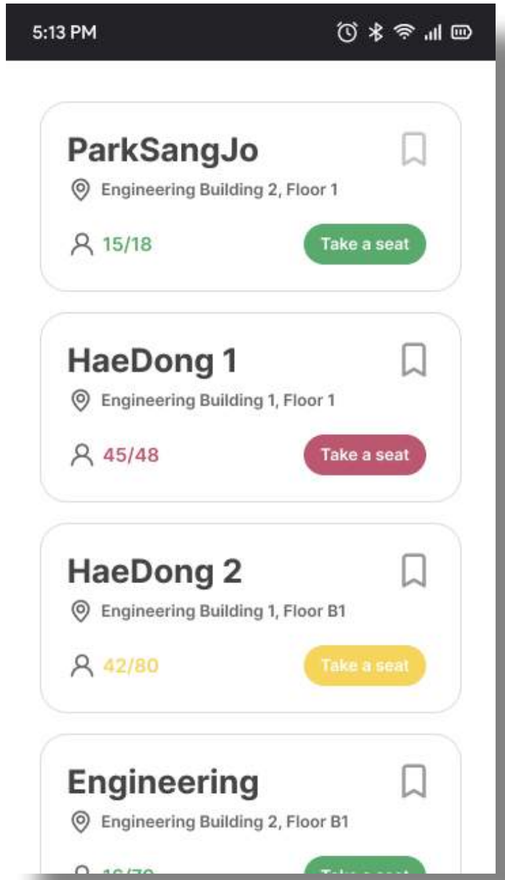
5) Json conversion

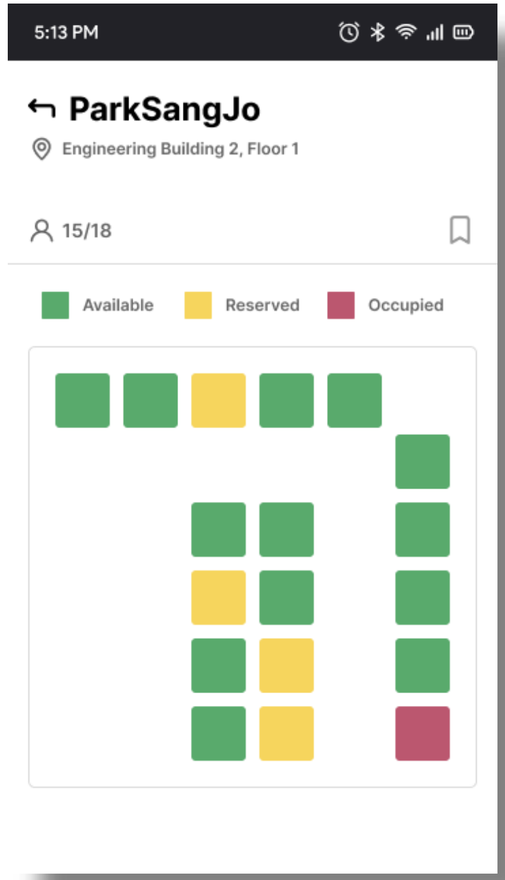


Json

{"psj": {"seat1": true, "seat2": true, "seat3": false, "seat4": true, "seat5": true, "seat6": true, "seat7": false, "seat8": true, "seat9": true, "seat10": false, "seat11": true, "seat12": true, "seat13": false, "seat14": true, "seat15": true, "seat16": false, "seat17": true, "seat18": false}}

PART 04 I UI / UX Design & Implementation



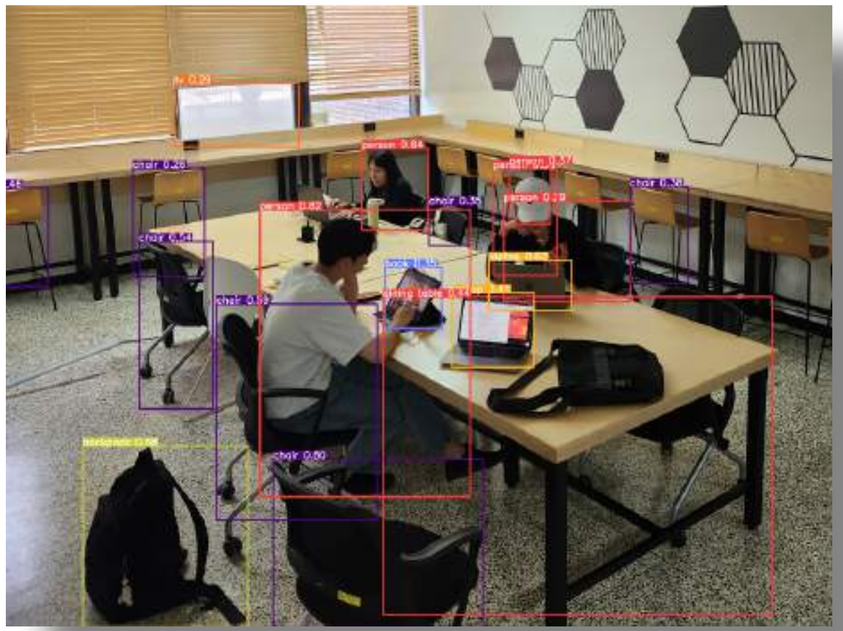


PART 04 I UI / UX Design & Implementation

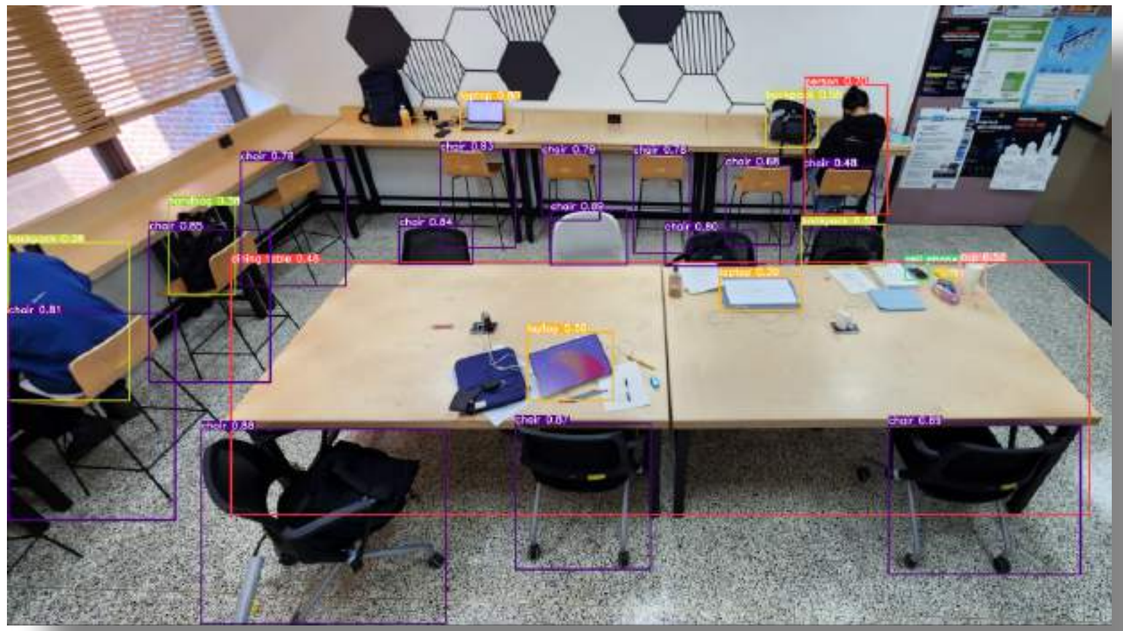
Frontend	**React & JavaScript**
Server	**nodejs, expressjs**
Release	**AWS**

Challenges

1) Optimizing Camera angle → reduce blind spots & minimize overlaps



→



as high as possible with a fixed angle

Challenges

2) Pixel vs. Ratio

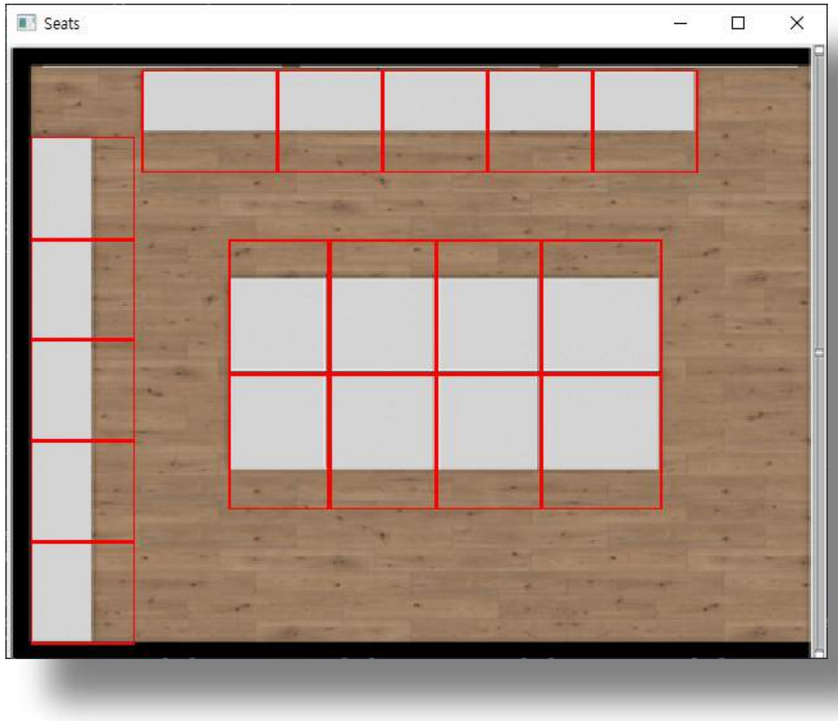
- **Initially proceeded with pixels, but later switched to ratios**

Ex) [55.39, 406.94] → [0.05539143458008766, 0.5086705088615417]

(1000 * 800)

- **Using absolute positions results in inaccurate coordinates due to proportion mismatch**
- **Using relative ratios allows for generalization**

Limitation



It needs to be applicable in various school spaces, but realistically,
there is a shortage of cameras, servers, and resources for blueprint creation.

Schedule

	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Week 12	Week 13	Week 14	Week 15
Refinement of the Topic														
AI Model Design														
Data Preprocessing														
Model & Algorithm Implementation														
UI & UX Design & Implementation														
Beta Service Launch														
Incorporation of Feedback & Revisions														

Future tasks

AI	• Combining functions into a single code • Executing every 5 ~ 30 seconds	김도엽, 박재윤 우다연, 최지민
Backend	• Smoothly synchronizing with the server • Accurately displaying transmitted data on the screen	김도엽
Frontend	• Implementing using React	박재윤, 우다연, 최지민

Capstone Global Design
Midterm Presentaion

THANK YOU

자리 있나요? Empty Seats?

TEAM A (A's) 김도엽 박재윤 우다연 최지민